

Waste and Recycled Building Materials under the Background of Economical Landscape

X. Wei* & J. W. Zhao

Department of Landscape Design, College of Art and Design, China University of Mining and Technology, Xuzhou 221116, China

ABSTRACT: The adjustment of industrial structure and rapid urbanization led to a large accumulation of construction waste and industrial solid waste. From the view of the nature matter and energy cycle, these wastes are "resource in the wrong place at the wrong time". Material is a material basis of garden construction. Today resources are increasingly scarce and environment is gradually deteriorating, the choice of garden materials mainly are natural resources; garden construction is still dependent on large-scale high rate of natural resource grab. Practical material saving measures are needed based on China garden construction status; using waste materials and recycled building materials as garden materials can spread waste recycling, change the traditional construction mode dependence on natural resources, which is where the purpose of the study based on. Waste and recycled building materials are widely used in the construction of social production and life. In terms of saving garden construction, they also have an important role and value. This article will give a brief introduction on saving garden, waste and recycled building materials, and explore the application of waste and recycled building materials in the construction of the garden on this basis. At the same time according to the situation of a conservation-oriented garden, the article presented the outlook for future prospects.

KEYWORDS: Saving-type garden; Waste; Recycled building materials.

INTRODUCTION

Urban construction will produce enormous and many kinds of waste; these wastes are processed into social development issues which must be addressed. Reuse of these wastes is currently the best approach. By recycling these wastes the use of new resources can be reduced. While for a number of limited wastes that can be processed to produce renewable building materials, they can be returned to production and construction with another form again. Landscape construction requires a lot of resources and waste and recycled building materials can be very promising in the process. Landscape construction should be based on the main characteristics of materials and specific requirements of garden construction for scientifically using the waste and recycled building materials.

OVERVIEW OF SAVING-TYPE LANDSCAPE AND WASTE RECYCLED BUILDING MATERIALS

Saving-type Landscape

Through the relevant measures with minimal resources and capital investment, promote landscaping achieving maximum overall efficiency; from the principle of natural resources and social resources cycle as well as rational use, one should conduct the maximum saving urban landscaping healthy and sustainable development, conservation and management, building construction, resources planning and design, so as to realize resource efficiency promotion; through the reduce on consumption and waste of resources, maximizing economic and social benefits is the main contents of saving-type garden construction. The planning roadmap on the use of waste and recycled building materials is shown as Figure 1 [1].

Waste and Recycled Building Materials

Renewable building materials are building materials which use construction waste and industrial solid waste as raw materials, and the wastes include construction waste and industrial solid waste. Where scrap metal materials, waste plastics, asphalt block, concrete block, brick fragments, waste rock, muck, waste wood are the main construction waste. Industrial solid waste contains gangue, fly ash, blast furnace slag, iron ore tailings and waste glass. It has been increasingly recognized which is the idea "garbage is resources put in the wrong place". The artistry, aesthetics, functionality and substance of waste has important significance in the use of landscape construction. The value patterning of waste and recycled building materials is shown as Figure 2.

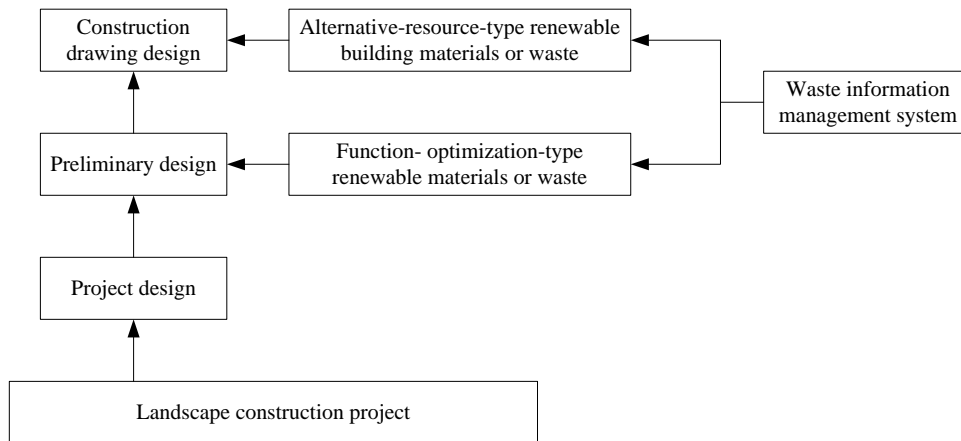


Figure 1. Planning roadmap on the use of waste and recycled building materials.

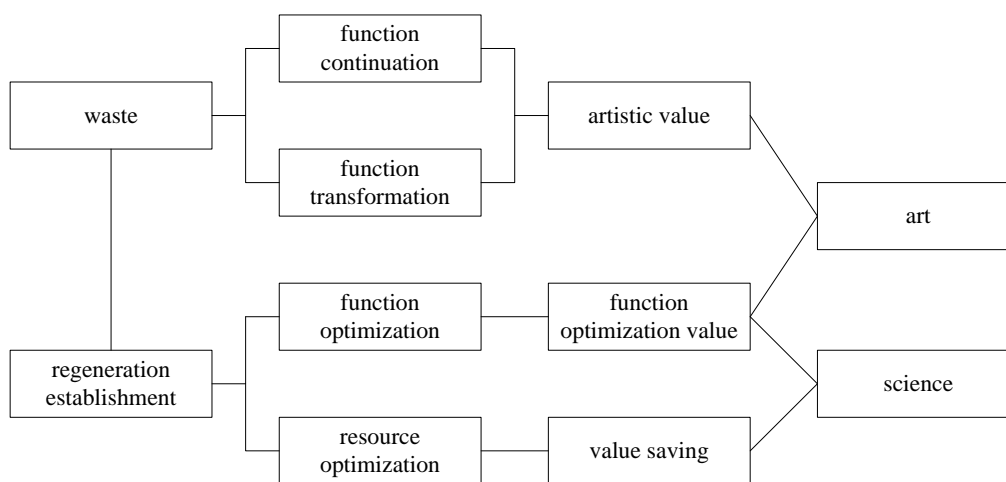


Figure 2. The value patterning of waste and recycled building materials.

APPLICATION STUDIES OF WASTE AND RENEWABLE BUILDING MATERIALS IN THE CONSTRUCTION OF CONSERVATION-ORIENTED GARDEN

Recycling-type industry in China has received the strong support of national policies, thus entered a period of rapid development. But in the field of landscape architecture, involved recycling industries are very small. In the engineering practice process, the application of the waste has a lot of difficulties, which makes the author produced a new way of thinking. How to apply regulated waste and recycled building materials into the garden, and transform the saving-oriented garden from theory to practice? Using waste and renewable building materials for landscape construction and conventional garden construction has many differences. Building the framework by research landscape can provide information warranty, encouraging policy promotion and review procedures of the application of waste and recycled building materials in order to contribute to the popularization and promotion of waste and building materials in the construction of landscape. The construction of waste information management system is shown as Figure 3.

Application of Waste in Wasteland Renovation Project

Many materials in wasteland project are derived from local materials; this approach is mainly due to the following aspects: the remained material in venue is a true portrayal of historical information, and a landscape created by the local materials can be easily reserved these historical information, expressing respect for the site and history by designers; most of abandoned land some distance from the city. If you do not use this way, the distance of transporting materials will be greatly increased, which will lead to increased cost of the project; most wasteland left materials will have better quality, and can be used directly without going through a very complicated process. Wasteland project is very necessary approach for the use of the site of the original materials, reducing the cost, and meanwhile conduct artistic promotion on the historical information contained in the waste, many of which have broad applicability, such as blast furnace slag

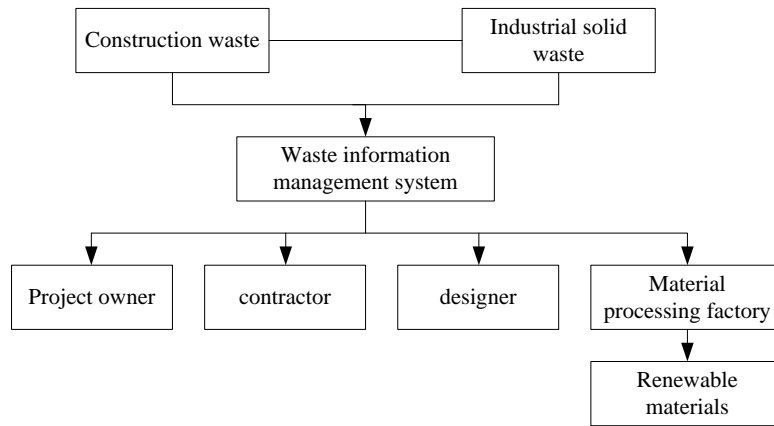


Figure 3. The construction of waste information management system.

with soft pavement surface, scrap metal was made into sculptures, rail was transformed into park road, and abandoned concrete block, brick and stone are combined into walls. Some practices may not be suitable for promotion. For example, abandoned heating usually should be detected; if quality standards it should first be applied to construction projects, using in the garden for outdoor stairs is actually a waste of resources. Abandoned waste recycling project is limited to the internal space and the project itself, which also limits the idea of waste recycling. The application of waste in wasteland renovation project is shown as Table 1.

Table 1. Application of waste in wasteland renovation project.

Types of waste	Applications	Application features
Waste heat	Steps	Similar with step specifications and shape
Waste brick	Reinforcing steel and gabion	The wall is easy to recycle, convenient for filling stone cage
	Masonry panel, the kerb	The continuation of brick function
Waste concrete	Recycled concrete	Convenient for large number of collection
	Concrete block gabion wall	Easy to recycle, convenient for filling stone cage
Waste wood	The wood mat formation, benches	The continuation of wood function
	Garden road tracks	Similar scale, and convenient for transformation
Scrap metal	Art sketch	Easy shaping

The Application of Waste in Municipal Road Engineering

In municipal road construction, many materials are derived from the exploitation of natural resources, such as cement stabilized crushed stone, and application of green concrete waste and recycled building materials under the background of Zhejiang-saving garden, and therefore in the field of municipal road construction, Study on waste replacing natural materials is earlier; many studies have been demonstrated in the century construction. The application of waste in municipal road engineering is shown as Table 2.

Application of Gangu and Fly Ash

Construction for the garden wall mainly uses gangue as raw materials for regeneration building materials; garden structures construction form and material requirements are very close. Gangue hollow brick of renewable building materials can be used for masonry of self-load-bearing walls; gangue baking-free brick can be used for load-bearing walls for masonry of walls. Fly ash can combine coarse river sand and gypsum into synthetic autoclaved fly ash brick; masonry bearing walls garden is the major method of renewable building materials. Adding ash into coal and water and after kneading, sintering and other processes will form fly ash fired hollow brick, which’s the main role is masonry of self-load-bearing walls in garden. The fly ash renewable building material with practical application is fly ash and slag ash blocks; add the fly ash into adhesives, water, gypsum, and cinder aggregate can produce pulverized coal slag slices

Table 2. The application of waste in municipal road engineering.

The waste species	Class processing technology	Applications	Approach of application
Construction waste	Recycling,edulcoration, crushing, hoof	Cement stabilized macadam	Packing, recycled aggregate
Gangu	Polypack	Ethyl alcohol and lime cement stabilized gravel	Recycled aggregate
The fly ash		Lime-fly ash stabilized aggregate, lime-ash soil sand, stabilized macadam, zhejiang green concrete	Cement packing, recycled aggregate
Steel slag			Packing, aggregate
The blast furnace slag		Graded sand and gravel	packing
Iron ore	Tailings recycling,edulcoration, crushing, hoof	Cement stabilized gravel, zhejiang green concrete	Packing, aggregate
Broken glass	Recycling,edulcoration, crushing, hoof	Cement stabilized gravel, zhejiang green concrete	Packing, recycled aggregate
Scrap tires	Recovery, crushing, hoof	Rubber asphalt	Packing, modified asphalt
Waste plastics	Recovery, crushing, hoof	Modification of zhejiang green	Packing, modified asphalt

after a series of manufacturing processes, masonry material in bearing wall of garden is its main purpose. As renewable building material with fly ash as raw materials, chemical and material of quartz-model materials have the highest stability and often be used in garden construction or the coastal or southern city [4].

Application of Waste in Temporary Landscape

In the temporary landscape, waste function is mainly reflected in three aspects which are artistic functional transform, historical information and symbolic role. Function transformation is the most basic function of waste, it can be said that artistic and symbolic role of historical information contain the role of function transformation. Waste function can form conversion with features required by design to replace part of the conventional materials in landscape. In the process of function transformation, if we can develop proper characteristic of waste, it can bring very interesting results, which requires designers to be very understanding of the waste and the replaced materials. Waste specification and form can coincide with functions in landscaping, which requires designers to have sharp observation during selection of materials. Connect the characteristics of the waste with the design requirements, thus complete the functional transform in waste recycling process. Part of the waste are conducted with the dyeing process in the application process, for example, discarded tires are painted with bright pink which are very easy to attract the attention of tourists. Materials with bright colors are limited, many materials which are easy to dye and have stable physical and chemical properties is an important thinking to select waste, which can bring a lot of active elements in the garden. In the use process of waste, safety assurance is a fundamental principle. There is a lot of waste which could have a negative impact for visitors, for example waste plastic bottles are easy to contaminate water or odor retention if you have not been brushing before using. Waste utilization need to be harmless processed, and cannot harm the health of tourists or affect functions. In conventional garden projects, one should try to select the materials with more stable physical and chemical properties; a lot of wastes are not stable enough or too fragile because of its physical and chemical properties, such as bagels in bagel garden were finally destroyed by the animals, which meaning of the whole garden would not exist. Many wastes contain the used traces which has become a carrier of information, through the artistic promotion by designers, forming very good visual effects and a heavy sense of history. After the dyeing process waste tires are in a matrix-type arrangement, forming a very interesting landscape, adding lively atmosphere for the lawn. Reuse of waste material are not be used as ordinary materials to simple shed or place but should use the artistic handling method to strengthen and inspire the historical information of the waste, in order to form pluralistic landscape value. The Application mode of waste in temporary landscape is shown as Table 3.

Table 3. Application mode of waste in temporary landscape.

Types of waste	Applications	Application features
Scrap tires	Dyeing, placed directly	Easy dyeing, easy to transport
Umbrella	Recycling rainwater form	Easy to recycle rainwater
Bread	Placed directly	Personal preference
Waste plastic bottles	Convenient water revetment combination	Flowerpot form is similar to flowerpot
Straw	Placed directly	It can cover grass and grow the soil
Furniture	Placed directly	Be corresponding to design theme
The old doors and windows	Placed directly	Be corresponding to design theme

Natural Waste Materials

Natural waste materials come from waste bark, leaves, grass, pruning branches debris, dead trees and other plant materials. Garden and forestry operation are often accompanied by a large number of trees and deadwood and leaves. In addition, developed agriculture regions tend to produce large amounts of crop residues; these organic plant residues is possible to breed bacteria and endanger the health of trees without proper cleaning up, while causing unexpected damage to the environment. For natural waste materials, the current approach is usually incineration disposal, the straw in northern region fields are usually incinerated as potassium, nitrogen back to the field. But the consequences of such an approach are a large area of air pollution, smog, haze that is one of its consequences. After using incineration process, it generated a lot of SO₂, NO₂ gas, which produces a fine stuff and powder which can aggravate atmospheric pollution.

WASTE MATERIALS RECYCLING IS A FEASIBLE WAY TO ACHIEVE LOW-CARBON GARDENS

Sustainable Development of Low-carbon Garden Promotion

The concept of low-carbon has been widely mentioned in the recent years, which refers to sustain economic growth at a high level, while maintaining low carbon dioxide emissions and slow down the negative impact of industrialization on the environment. The original purpose of landscape is for people to create better living conditions, which coincides with the nature of low-carbon ideas. Reusing waste materials in garden, we will use some of the materials which cannot be reintroduced for the massive public facilities, so concept of sustainable development can be deeply rooted. At the same time the waste is placed, so massive and nationwide gardening movements are no longer expensive.

Widely Acceptance on Various Materials Widely in Landscape Projects

Architectural engineering are more demanding on material requirements; the slightest mistake may have resulted irreparable consequences. Therefore, the use of waste materials will be worried about whether the hardness and strength of the materials can meet the requirements. Compared to the demanding construction projects, landscape projects reflect its unique randomness and operability. Small gardens made by waste materials and old barrels and cups used for flowerpots do not exist security risks. In the recovery and use of garden materials, the materials which can be used are very wide and more natural. Moreover, part of the landscape garden material has faster landscaping speed, and has both high value and also high ornamental value. Finally, for modern people having the concept of “green” and “low carbon”, seeing and using such fresh and new small scene into garden construction is the enjoyment of beauty.

Input Control of Building Materials in the Garden Construction Engineering Controls

In the garden construction, the use range of materials is very wide, mainly including green seedlings materials, garden construction materials, installation materials of water and power; the choice of materials should follow the principle "high-quality, low prices, more comparison, short transport" principle, try to choose economical and practical kind. In the choice of materials, the same quality, the principle of proximity and the cost of transport is also our concern. Therefore, before purchasing seedlings, be sure to carry out the comprehensive statistics for whole project seedlings; according to the construction progress at the scene, the procurement of transportation should be once completed as much as possible to ensure that transport vehicles are full of cars when planning.

ENLIGHTENMENT AND OUTLOOK

In China, there is no authoritative department for certification work of all kinds of garden materials and the material certification also need the support of the garden material evaluation system to exist, which is a relatively paradoxical situation. Therefore, this paper first proposed that garden construction management department should present incentive policies through awards assessment, stimulating application reuse ratio of waste and proportion of renewable building materials while carrying out material certification; only through certified materials one can participate in the awards. When promoting regeneration of waste and building material applications, the certification work of garden materials should be gradually carried out.

Economical garden still remain the level of the principles and methods at present, without the introduction of any evaluation criteria and formulation, which makes economical gardens only affected the practitioners of landscape industry on the consciousness level, but not guide people to carry out practical activities at implementation level. The above mentioned garden materials evaluation system should be part of garden materials in economical garden evaluation criteria, but the extent of savings on various aspects such as energy saving, reasonable degree of plant configuration and water efficiency will require quantitative analysis of evaluation standard. Research on saving-type garden evaluation criteria can provide enormous help for the industry management department to carry out relevant provisions, so as to lay a solid foundation for the realization of saving-type garden, promoting the application of waste and recycling materials in landscape at the policy level. The article analyzed economical garden, waste and recycled building materials, and explored the application of waste and recycling building materials in the construction of the garden. Uses of waste and recycled building materials is designed with the principle of appropriate time and place, function first and art enhancing. We avoid behavior of recycled waste at all costs to promote early intervention from designers on construction project. Harmless treatment and capabilities of waste and recycled building materials and quality warrantee is a prerequisite. Enhancing the art of waste can maximize their artistic value. But there are still some limitations in this article; we hope the relevant personnel can strengthen the attention, improving utilization level of waste and recycling building materials in the construction of the garden, which are in line with the development trend of the future economical gardens.

REFERENCES

- [1] L. S. Zhang, J. H. Wang, and P. Gong, "Investigation and promotion of economical landscape construction in Nanchang city route", *J. Guangdong Agricultural Sciences*, no. 19, pp. 52-56, 2012.
- [2] L. S. Zhang, H. L. Zhang, and F. Z. Wen, "On the economical landscape ecological technology", *J. Heilongjiang Agricultural Sciences*, no. 7, pp. 77-82, 2013.
- [3] Z. Q. Liu and G. W. Hong, "The efficiency of the intensive use of city greenbelt landscape evaluation index system", *J. Fujian Forestry Science and Technology*, no. 1, pp. 154-158, 2014.
- [4] W. Wang, "Landscaping earthwork construction techniques of terrain", *J. Real Estate Daokan*, no. 3, pp. 264-268, 2013.
- [5] H. Pan, "Research on the construction technology of earth and earth (J) in landscape engineering", *Chinese Residence*, no. 24, pp. 13-16, 2014.
- [6] Z. H. Yao and X. W. Zhao, "Discussion on the construction technology of earth moving terrain in Landscape Architecture", *Science and Technology Communication*, no. 5, pp. 156-162, 2012.
- [7] J. F. Yang and B. T. Mao, "The times and the history of city landscape design of the continuous", *J. Information of Agricultural Science and Technology (Modern Garden)*, no. 8, pp. 11-12, 2010.
- [8] J. X. Wu, "The regional characteristics of urban plant culture, local plants, should be the main body of the urban landscape construction", *Ordos Culture*, no. 4, pp. 15-18, 2011.
- [9] C. T. Liu, "Cost control of landscape engineering construction project", *Heilongjiang Science and Technology Information*, no. 8, pp. 11-18, 2011.
- [10] Z. X. Zhao, "The economic value of the scientific distribution of landscape architecture and landscape architecture", *Shanghai Landscape Engineering*, no. 20, pp. 21-23, 2012.